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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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MCDERMOTT, WILL & EMERY
Suite 3400
2049 Century Park East
Los Angeles, CA 90067

EXAMINER	
SELLERS, DANIEL R	

ART UNIT	PAPER NUMBER
2615	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/23/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)
	10/766,599	TAYLOR ET AL.
	Examiner	Art Unit
	Daniel R. Sellers	2615

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 July 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments, see p. 14, filed 7/24/06, with respect to claims 1-24 have been fully considered and are persuasive. The rejections of claims 1-24 have been withdrawn.

Claim Rejections - 35 USC § 101

2. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

3. **Claims 18-24** are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Claim 18 is directed towards software as evidenced by claim 17. Therefore the method claim, when interpreted broadly in light of the specification, is seeking protection for software without using the current acceptable language, such as a computer readable medium having a stored computer program or the like. The claim is deemed non-statutory because the method claim does not fully realize a practical application. The last step indicates that a determination is made, but it does not put forth a step that positively discontinues measurements, or provides a practical application, such as a data acquisition system responding to the determination.

Claim 19 is directed towards software as evidenced by claim 17. Therefore the method claim is seeking protection for software and is non-statutory. A practical application, as stated previously, is not claimed. The claim seeks protection for a

method comprising, in part, a step to determine when a gap appears in a plot of values, however it does not claim a practical application, such as displaying the plot of values, displaying the spectrum, or other such practical outputs.

Claim 20 is non-statutory because it depends on claim 19.

Claim 21 is directed towards software as evidenced by claims 17 and 23. Therefore the method claim is seeking protection for software. The claim is deemed non-statutory because the method claim does not fully realize a practical application. The last step of the method claim commands the data acquisition step to discontinue measurements and the previous step requests more measurements, however neither of these steps, when realized by software, provides a practical applicability, such as a data acquisition system responding to the requests.

Claims 22 and 23 are non-statutory because they depend on claim 21.

Claim 24 is directed towards software as evidenced by claim 17. For similar reasons as claims 18, 19, and 21, claim 24 is non-statutory. A practical application, such as a display of the plot values, display of the spectrum, or the like, is not positively recited.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. **Claims 1, 2, 4, 6, 14, 15, and 17-24** are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Smith, USPN 5,420,508.

6. Regarding **claim 1**, see Smith

An apparatus for performing spectral analysis, the apparatus comprising:
a. a data acquisition system configured to measure a signal emitted from a sample in response to excitation energy applied thereto (Col. 5, lines 37-63; and Fig. 1, units 104-3, 105-1, 105-3, and 106*), and to average the measured signal over a plurality of measurements to generate an averaged signal* (Col. 7, lines 46-52);

b. a data processing system including:
a noise-reduction pre-processor configured to create a vector space from said averaged signal (Col. 7, line 66 - Col. 8, line 9*), and to generate one or more singular values and corresponding eigenvectors of a correlation matrix constructed within said vector space, said vector space containing a noisefree signal subspace and a noise subspace, said singular values including noisefree singular values associated with said noisefree signal subspace, and noise singular values associated with said noise subspace* (Col. 8, line 60 - Col. 9, line 56; and Fig. 3, steps 60, 62, and 64)*; and*

c. a control system configured to identify a gap between a smallest noisefree singular value and a first noise singular value, so as to request the data acquisition system to perform additional measurements if no such separation can be identified, and to prevent further measurements from being made by the data acquisition system if the appearance and stability of said gap can be established (Col. 9, line 45 - Col. 10, line 20; Col. 10, lines 28-63; Col. 4, lines 34-45; and Fig. 3, steps 60, 66, 68, 70, and 72).

Smith teaches an NMR spectral analysis with these features. Smith teaches that the smallest singular values correspond to noise and cause the statistical fitting procedure (the M-L fit) to produce an erroneous result (Col. 2, line 42 - Col. 3, line 28; and Col. 3, line 59 - Col. 4, line 27). The control system reduces the amount of noise singular values in the Z1 subset (Col. 10, lines 36-54, or steps (4)-(11)), which has the same effect as identifying the gap between the smallest noisefree singular value, or the smallest signal eigenvalue, and the noise singular value, or the noise eigenvalue. Smith teaches that the control system performs additional measurements when the gap is not defined, or the statistical fit provides erroneous errors, and prevents further measurements when the gap is stable (i.e. the M-L fit, or statistical fit, provides plausible

results as a result of accepting the Eigenvectors that fall within 3, 5, or 7 standard deviations from the mean, or dropping the noise associated singular values from calculations) (Col. 10, lines 4-20; Col. 10, lines 36-44, or steps (4)-(6); and Fig. 3, steps 60, 62, 64, 66, 68, and 70). It is inherent that eigenvectors, and their associated eigenvalues, or singular values, are very large or very small when they fall outside 3, 5, or 7 standard deviations from an expected, or mean, value.

Worley, presented in prior Office Actions, supports the association of small singular values, or eigenvalues, with a noise subspace and the large eigenvalues are associated with a noisefree subspace. Smith is teaching the same idea, but uses different terminology, wherein noise is associated with data that shows multicollinearity (Col. 9, lines 47-50).

7. Regarding **claim 2**, the further limitation of claim 1, see the preceding argument with respect to claim 1. Smith teaches an NMR spectral analysis using RF excitation pulses, wherein an NMR transient, or free induction decay (FID), is measured.

8. Regarding **claim 4**, the further limitation of claim 1, see Smith

wherein said noise-reduction preprocessor comprises:
a. a matrix generator configured to form a vector space from the averaged signal and constructing a correlation matrix within the vector space, the vector space containing a noisefree signal subspace and a noise subspace (Col. 7, line 46 - Col. 8, line 9; and Col. 8, lines 41-49)*;*
b. a matrix diagonalizer configured to diagonalize the correlation matrix to obtain its singular values and the corresponding eigenvectors, the singular values including noisefree singular values associated with the noisefree signal subspace, and noise singular values associated with the noise subspace (Col. 8, line 60 - Col. 9, line 56; and Col. 10, lines 30-56)*; and*
c. a signal projector configured to project the averaged signal onto the noisefree subspace to generate a noise-reduced signal (Col. 9, lines 57-65).

Smith teaches noise-reduction preprocessor with these features. Smith constructs a vector space from averaged signals (Col. 7, lines 46-61), and constructs a correlation

matrix within the vector space (Col. 9, lines 13-19), wherein it is known that this vector space contains a noisefree signal subspace and a noise subspace (Worley teaches that an Eignenspace of the correlation matrix can be partitioned into a noisefree subspace and noise subspace, p. 2130, paragraph 3). Smith uses principal component analysis, which reads on a matrix diagonalizer.

9. Regarding **claim 6**, the further limitation of claim 1, see the preceding argument with respect to claim 1.

... wherein said data acquisition system is configured to sample each measured signal with a sampling period τ, and to average the corresponding sample points over said plurality of measurements, so as to store said averaged signal as a discretized set of N data points C_n (n = 0 .... , N-I). (Col. 7, lines 17-61).

Smith teaches an apparatus with these features.

10. Regarding **claim 14**, see the preceding argument with respect to claim 1. Smith teaches these features.

11. Regarding **claim 15**, see the preceding argument with respect to claim 1. Smith teaches these features.

12. Regarding **claim 17**, see the preceding argument with respect to claim 1. Smith teaches these features.

13. Regarding **claim 18**, see the preceding argument with respect to claims 1 and 4. Smith teaches these features.

14. Regarding **claim 19**, see the preceding argument with respect to claims 1 and 4. Smith teaches these features.

15. Regarding **claim 20**, the further limitation of claim 19, see the preceding argument with respect to claims 19 and 2.. Smith teaches these features.

16. Regarding **claim 21**, see the preceding argument with respect to claim 1. Smith teaches these features.

17. Regarding **claim 22**, the further limitation of claim 21, see the preceding argument with respect to claim 1. Smith teaches a user operated method (Col. 6, lines 50-51).

18. Regarding **claim 23**, the further limitation of claim 21, see the preceding argument with respect to claim 1. Smith teaches these features as a computer implemented method.

19. Regarding **claim 24**, see the preceding argument with respect to claim 1. Smith teaches these features.

Claim Rejections - 35 USC § 103

20. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

21. **Claims 3 and 16** are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith as applied to claim 1 above, and further in view of Konno et al., USPN 5,148,379 (hereinafter Konno).

22. Regarding **claim 3**, the further limitation of claim 1, see Smith

3. An apparatus in accordance with claim 1, wherein said control system comprises:

a. a graphics system adapted to generate a plot of said singular values (Col. 5, lines 52-55 and Fig. 1, unit 110)*;*

b. a pattern recognition system adapted to identify a gap in said plot between said noisefree singular value and said adjacent noise singular value, and to verify the stability of said gap (Col. 9, line 45 - Col. 10, line 24; and Fig. 3, step 70)*; and*

c. a command signal generator, responsive to said pattern recognition system, configured to generate an output signal requesting for more measurements from said data acquisition system, in the absence of an identifiable gap, and to generate an output signal requesting that further measurements be

discontinued, if the appearance and the stability of said gap has been established by said pattern recognition system (Col. 10, lines 28-63; Col. 4, lines 34-45; and Fig. 3, steps 60, 66, 68, 70, and 72).

Smith teaches the features of a display, the pattern recognition system, and the command signal generator. However, Smith does not teach that the graphics system generates a plot of the singular values. Konno teaches the display of eigenvalues, or singular values, for verification (Col. 25, lines 12-17; and Fig. 30). It would have been obvious for one of ordinary skill in the art at the time of the invention to combine the teachings of Smith and Konno for the purpose of verifying the accuracy of the system (Col. 4, line 33 - Col. 5, line 20).

23. Regarding **claim 16**, see the preceding argument with respect to claims 1, 3, and 4. The combination of Smith and Konno teaches these features.

24. **Claims 5, 7, and 8** are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith as applied to claim 4 above, and further in view of Freeman, USPN 3,752,081.

25. Regarding **claim 5**, the further limitation of claim 4, Smith teaches the features of claim 4. However, Smith does not teach the generation of a spectrum by converting the noise-reduced signal into a frequency-domain. Freeman teaches this feature (Col. 5, lines 27-54). It is inherent that the noise-free component is used to create the desired spectral plot. It would have been obvious for one of ordinary skill in the art at the time of the invention to combine the teachings of Smith and Freeman for the purpose of generating a spectrum to be displayed later as a spectral plot.

26. Regarding **claim 7**, the further limitation of claim 6, Smith teaches the features of claim 6, wherein it is inherent that the system is configured to store each data point as a noisefree component and a noise component. This is inherent because Smith separates the data into these two sets. In the combination, Freeman teaches the step of converting the input data into frequency components for a spectral analysis, wherein it is inherent that the data processing system needs to store the finite sum of damped complex harmonics weighted by respective coefficients, or frequency components.

27. Regarding **claim 8**, the further limitation of claim 7, see the preceding argument with respect to claim 7. Freeman teaches a Fourier transform, wherein the components are described by the claimed mathematical function.

28. **Claims 9-13** are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith as applied to claim 1 above, and further in view of Meyer et al., USPN 5,485,086 (hereinafter Meyer).

29. Regarding **claim 9**, the further limitation of claim 1, see the preceding argument with respect to claim 1. Smith teaches the features of claim 1, however does not teach a windowing subsystem. Meyer teaches a windowing system configured to apply a windowing filter to a Fourier transform, which inherently generates a decimated signal having a limited bandwidth (Col. 3, line 30 - Col. 4, line 4). This temporal filtering can be done after averaging the acquired signals or after singular value analysis, and it would be obvious to employ either of these methods. It would have been obvious for one of

ordinary skill in the art at the time of the invention to combine the teachings of Smith and Meyer for the purpose reducing image artifacts caused by movement of the sample.

30. Regarding **claim 10**, the further limitation of claim 9, see the preceding argument with respect to claim 9. It is inherent in the combination that the decimated signals are converted back into the time domain and stored as a set of decimated points. It is also inherent that the resulting signal has a signal length smaller than the original.

31. Regarding **claim 11**, the further limitation of claim 10, see the preceding argument with respect to claim 1. Smith teaches the feature of creating a vector space, which has M dimensions. The N-M+1 linearly independent vectors are represented by the largest eigenvectors, as taught by Smith and Meyer teaches the decimation of the data. It would have been obvious to decimate the data before performing the principal components analysis as stated previously.

32. Regarding **claim 12**, the further limitation of claim 11, see the preceding argument with respect to claim 1. Smith teaches a correlation matrix of real valued signals. By definition, it is an inherent feature of a correlation matrix of real valued signals to be Hermitian, and since it is formed from principal components analysis and contains only positive eigenvalues, the matrix is covariant. The mathematical equation is a well-known equation for determining a correlation matrix, and the Office takes Official Notice that this equation is used to acquire the correlation matrix.

33. Regarding **claim 13**, the further limitation of claim 11, see the preceding argument with respect to claim 11. Smith teaches a system analyzer that uses singular value decomposition techniques. The system as taught by Smith, inherently includes a

method of projecting a signal onto eigenvectors. The Office takes Official Notice that this general equation is used for projection.

Conclusion

34. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

35. Manolakis, Dimitris G., Ingle, Vinjay K., and Kogon, Stephen M., "Statistical and Adaptive Signal Processing", Sections 3.5.1 - 3.5.3 (pp. 125-133) teaches the Karhunen-Loève transform for continuous signals and the discrete Karhunen-Loève transform (DKLT) for discrete signals. The DKLT is also known as the Hotelling transform (p. 130).

36. Gonzalez, Rafael C. and Woods, Richard E., "Digital Image Processing", pp. 677-679, teaches the Hotelling transform, which is also known as the principal components transform (p. 679).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel R. Sellers whose telephone number is 571-272-7528. The examiner can normally be reached on Monday to Friday, 9am to 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sinh Tran can be reached on (571)272-7564. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

DRS

SINH TRAN
SUPERVISORY PATENT EXAMINER